

RETARDATION OF GROWTH AFTER TRAUMATIC EPIPHYSEAL SEPARATION

By

GUNNAR REDELL, M.D.

Surgeon-in-chief, Central Hospital, Umeå, Sweden

Traumatic epiphyseal separations in the long bones of the extremities are so common, that every surgeon dealing with traumatic surgery will find frequent opportunities to meet and treat them. This has been the case particularly in later years, as traffic accidents are becoming more and more numerous. However, while the frequency of these cases is great, and the literature on the subject extensive, it is astonishing to find how little seems to be published regarding the retardation of growth as a late sequela of the injuries. One gets the impression, that such complications might be fairly rare, and in any case not presenting themselves as major surgical problems.

Bergenfeldt, in his comprehensive monography, published 1933, has collected not less than 310 cases of epiphyseal separation. One finds here only a few patients with disturbances of growth, and only in one of these does the deformity seem to be of such a degree, that one can speak of a functional disorder. Not even this patient was in need of corrective measures.

The author has had the opportunity to treat two cases of functional disorder after epiphyseal separation, in each case the distal end of the radius being affected. One of these cases (Case 1) did not present any difficult surgical problem. The other one, however, (Case 2) brought the surgeon up against hitherto unsolved questions. *In the hope of receiving a therapeutic suggestion from the readers of this Journal*, I find it worthwhile to publish my two cases.

Case 1. Male, born 1930. Since birth he has had reduced muscle power and atrophy of the left half of his body, probably as a result of a trauma during delivery. In spring 1945 he acquired "a fracture" of his right wrist. He was treated in a small surgical clinic with plaster-of-Paris bandage without any X-ray examination being made. Half a

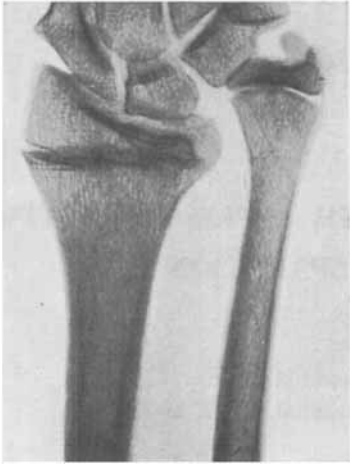


Fig. 1. Case 1.



Fig. 2. Case 1.

year later he noticed an increasing deformity of his wrist, reduced motility and muscle power.

July 12, 1948, he was taken to the surgical department of Falu Hospital. *His right wrist* showed a considerable protrusion of the styloid process of the ulna and a volar flexion of not more than 20 degrees (left wrist 45). *X-ray examination:* (fig. 1) The distal end of the radius is deformed in quite a considerable degree with enlargement of the epiphyseal portion. The epiphysis is lower than normal. The ulna is about one centimeter too long in comparison with the radius. An increased distance is noticed in the distal radio-ulnar articulation. Lipping of the metaphyseal margins, especially at the volar and dorsal aspect of radius. The deformities mentioned may be attributed to a disturbed growth after an epiphyseal separation. Signed: Sahlstedt.

Operation was performed on July 13 by the author. Incision along the ulnar margin of the wrist. The ulnar diaphysis was divided at two points, and a piece 17 mm. in length resected. With the aid of a small peg of prepared bone ("os purum") the two cut ends were fixed to each other, and by ulnar deviation a good contact was accomplished. Plaster-of-Paris bandage in ulnar flexion.

The patient left the hospital June 7. A new plaster-of-Paris bandage was applied with some correction Aug. 24, but otherwise the healing was normal.—On Nov. 20, 1948, the patient found his wrist fully usable. Pronation and supination amounted to 90 degrees on the right side and 100 degrees on the left. The dorsal flexion was 45 degrees on both sides, but the volar flexion was 35 degrees on the right and 45 on the left. The X-ray-picture is shown in fig. 2.

The last follow-up examination was made on March 31, 1955. The patient was at that time 25 years of age. He works as an automechanic and considers he has full power and motility of his wrist. On inspection a slight protrusion of the distal ulnar end is found. The motility is normal and the same on both sides, but the supination is reduced less than 10 degrees. X-ray finding see fig. 3.



Fig. 3. Case 1.

As this patient now is fullgrown, there is no reason to expect a new deformity. *The result of the operative correction must be considered as ideal.*

Case 2. Girl, born March 20, 1945. She was taken to the surgical department of the Central Hospital, Umeå, on Aug. 21, 1948, after having, shortly before her admission, got hold of a loaded pistol, found in her home, and fired it against herself.

On admission her general condition was very little affected. She was, however, a little pale and had some difficulty with her breathing. On the dorsal side of her right hand, a few centimeters distally from the wrist joint, an entrance wound, the size of a small fingertip was found, and about 5 centimeters proximally of the same joint on the volar aspect an exit-wound was found. Close to her right nipple was another entrance wound and on her back, medially of the apex of the right scapula one could see the exit. The bleeding from the four wounds was very slight.

An X-ray examination of the wrist showed a slight raggedness of the distal end of the radius, where the bullet might have torn off a small fragment of bone. The thorax was without any particular signs. Signed: Junghagen.

The wounds were excised and sutured, and the healing was completely without complications. The girl left the hospital on Aug. 27.

1952, October 6, the girl and her father came to my office, because the parents had noticed an increasing deformity of her wrist and were becoming anxious. The girl herself, now 7½ years of age, seemed to be completely unaware of anything being wrong. *The examination* showed a bayonet malformation of the wrist with a marked radial dislocation. The volar flexion was 80 degrees, the dorsal flexion 70.

X-ray examination now revealed an extreme defect of the distal end of the radius (fig. 4). About two thirds of the epiphysis on the radial side was missing, and the remaining third was rotated about 30 degrees. In this way the radius had been shortened mostly corresponding to the defective two thirds and this was the explanation of the radial displacement of the hand.

The seemingly slight injury of the distal end of radius had apparently destroyed about two thirds of the epiphysis, while still functioning tissue was left on the ulnar third.

If the etiology was unusual, the therapeutic problem was so in a much higher degree. The injury of the two thirds must be accepted as irreparable. As long as the growth from the still functioning third is going on, the deformity of the hand must be increasing. One had therefore to count with a more and more marked displacement of the wrist with an increasingly impaired function and an embarrassing appearance. One could not expect that the process should come to a standstill until the growth of the wrist was completed. Further one must count with a great risk of decreasing function by arthrosis and other changes in the wrist-joint.

Delaying corrective measures until the status was final would mean a risk of irreparable disturbances of function. An immediate attempt at adjustment could, possibly, give a temporarily satisfactory result. But it certainly must be followed by one or more operations later on. After weighing the pros and cons, the author decided it would be best to choose the second alternative, i.e. to try a correction as soon as possible.

The therapeutic problem was discussed with an experienced orthopedist, Doctor Harald Nilsson in Stockholm, whose advice I appreciate very much, and the following plan was adopted: First of all, one must try to put, as far as possible, the distal plane of the radius in its correct position. This ought to be done by a wedge-shaped osteotomy just proximal of the epiphysis and a following rotation of the distal fragment about 30 degrees. To attain contact and healing between the fracture-ends, one had to add an osteotomy with shortening of the

ulnar diaphysis. A certain shortening of the forearm must be the result of this. But this disadvantage had to be accepted. The planned operation will be understood from fig. 4.

The operation was performed by the author on Nov. 11, 1952. After exposing the distal part of the epiphysis of the radius, a wedge-formed piece, 9 millimeters at the base, was removed with a chisel. From another incision a 12–13 millimeter long piece of the ulnar diaphysis was removed and the ends of the fragments were fixed by a Kirschner wire, introduced from the olecranon. After this one could easily obtain an exact position of the radial fragments, and they were kept in place by a steel wire pulled through two bore-holes. The exterior contour of the hand now seemed to be normal. The position after the operation, and after the forearm had been put in plaster-of-Paris bandage, is clear from fig. 5.

The girl left the hospital on Nov. 17, after a normal and rapid healing. The position of the hand seemed to be not far from normal, and the preliminary result of the operation was considered to be as good as could be expected.

At a follow-up on Oct. 17, 1953, the girl herself was completely satisfied with her situation. It was, however, evident that the displacement had increased, and this was verified by an X-ray examination. The angulation of the radial epiphysis was again enlarged, with a radial dislocation as a consequence. Further operation was postponed until spring 1954.

An examination on July 23, 1954, revealed a further deviation of the wrist, and the girl was taken to the hospital on Aug. 4. Her right forearm was now considerably shorter than her left. I decided that the technique used at the first operation could therefore not be made use of again. At this *operation* I made a wedge-shaped osteotomy on the radial diaphysis and rotated the loose fragment round 180 degrees. In this way the epiphysis could be turned into a more normal position. The result is made clear from fig. 6. The healing was uncomplicated.

The last follow-up examination was made on *Febr. 2, 1955*. Also at that time the deformity had again increased. And the girl mentioned for the first time, that she felt her hand fatigued at strain, which must be interpreted as an incipient functional insufficiency. Fig. 7.

The situation is now in principle the same as before the first operation. But in planning for a new intervention the choice of method is more difficult, and *the question is, what is advisable now?* Something must be done.

The case just mentioned seems to present a picture of special interest compared with an experimental study, published in 1950 by

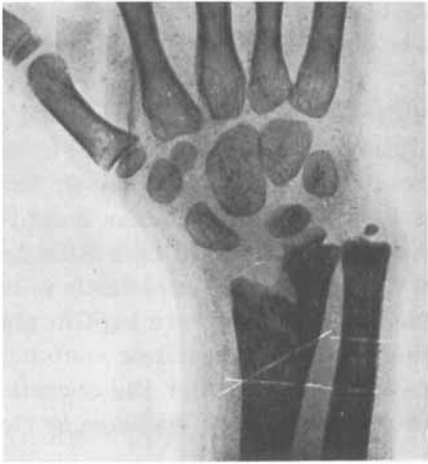


Fig. 4. Case 2.



Fig. 5. Case 2.



Fig. 6. Case 2.

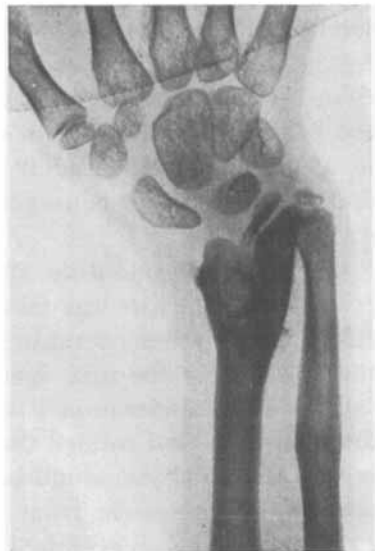


Fig. 7. Case 2.

A. Langenskiöld & W. Edgren in Helsinki, Finland. As early as 1947 Langenskiöld published the results of a research work regarding the etiology of *Ollier's* disease. He considered this disease being the result of a localized and partial disturbance of the epiphyseal growth-zone. By exposure of a well demarcated portion of the distal radial and ulnar epiphyses to X-rays, the authors have attained a retarded growth, well illustrated by fig. 8.

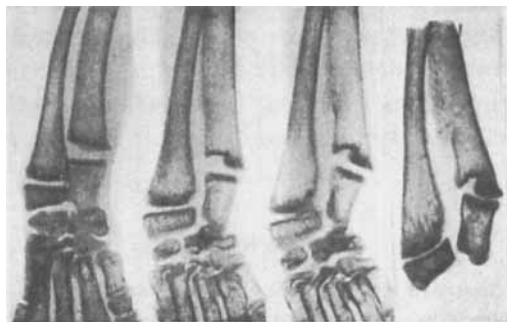


Fig. 8.

From A. Langenskiöld & W. Edgren.

The similarities between *Langenskiöld-Edgren's* pictures and those of my patient seem to me to be very striking. The gun-shot accident of 1948 as well as the X-ray treatment of the animals have resulted in a final retardation of growth in a well circumscribed area with disturbance of development as a result.

S U M M A R Y

The author reports on two cases of retarded growth after traumatic epiphyseal separation of the distal end of the radius. In one of these the cause was a gun-shot accident with destruction of two thirds of the epiphysis, resulting in a very marked dislocation of the hand. This case has been and still is presenting a difficult surgical problem. The author hopes, that he will get valuable and practical suggestions from the readers of this Journal.

R E S U M E

L'auteur rapporte deux cas de croissance retardée après séparation épiphysaire traumatique de la partie distale du radius. Dans l'un de ces cas, il s'agissait d'un accident à la suite d'un coup de fusil avec destruction de deux tiers de l'épiphyse, d'où il est résulté une dislocation très marquée de la main. Ce cas a soulevé et soulève toujours un problème chirurgical difficile. L'auteur espère qu'il recevra de la part des lecteurs de cette revue des suggestions précieuses et pratiques.

Z U S A M M E N F A S S U N G

Der Verfasser berichtet über zwei Fälle von verzögertem Wachstum nach traumatischer Lösung des distalen Radiusendes. In einem dieser

Fälle war die Ursache ein Gewehrschussunfall mit Zerstörung von zwei Dritteln der Epiphyse, der mit einer sehr ausgesprochenen Verschiebung der Hand endete. Dieser Fall war und ist fortlaufend ein schwieriges chirurgisches Problem. Der Verfasser hofft dass er wertvolle und praktische Ratschläge von den Lesern dieser Zeitschrift erhalten wird.

REFERENCES

- Bergensfeldt, Ernst:* Beiträge zur Kenntnis der traumatischen Epiphysenlösungen an den langen Röhrenknochen der Extremitäten. Acta Chir. Scandinav., Suppl. 28, 1933.
- Langenskiöld, A.:* Normal and Pathological Bone Growth in the Light of the Development of Cartilaginous Foci in Chondrodysplasia. Acta Chir. Scandinav., 95: 367–386, 1947.
- & *W. Edgren:* Imitation of Chondrodysplasia by Localized Roentgen Ray Injury—an Experimental Study of Bone Growth. Acta Chir. Scandinav., 99: 353–373, 1950.